

uniformity, I hasten to explain that in this matter we have no choice; we may feel convinced that the rate has varied from time to time, but in what direction, or to what extent, it is impossible to conjecture. That the sun was once much hotter is probable, but equally so that at an earlier period it was much colder; and even if in its youth all the activities of our planet were enhanced, this fact might not affect the maximum thickness of deposits. An increase in the radiation of the sun, while it would stimulate all the powers of subaerial denudation, would also produce stronger winds and marine currents; stronger currents would also result from the greater magnitude and frequency of the tides, and thus while larger quantities of sediment might be delivered into the sea they would be distributed over wider areas, and the difference between the maximum and average thickness of deposits would consequently be diminished. Indications of such a wider distribution may perhaps be recognised in the Palaeozoic systems. Thus we are compelled to treat our rate of deposition as uniform, notwithstanding the serious error this may involve.

The reasonableness of our estimate will perhaps best appear from a few applications. Fig. 2 is a chart, based on a map by De Lapparent, representing the distribution of land and sea over the European area during the Cambrian period. The strata of this system attain their maximum thickness of 12,000 feet in Merionethshire, Wales; they rapidly thin out northwards, and are absent in Anglesey; scarcely less rapidly towards Shropshire, where they are 3000 feet thick; still a little less rapidly towards the Malverns, where they are only 800 feet thick; and most slowly towards St. David's Head, where they are 7400 feet thick. The Cambrian rocks of Wales were in all probability the deposits of a river system which drained some vanished land once situated to the west. How great was the extent of this land none can say; some geologists imagine it to have obliterated the whole or greater part of the North Atlantic Ocean. For my part I am content with a somewhat large island. What area of this island, we may ask, would suffice to supply the Cambrian sediments of Wales and Shropshire? Admitting that the area of denudation was ten times as large as the area of deposition, its dimensions are indicated by the figure *a b c d* on the chart. This evidently leaves room enough on the island to furnish all the other deposits which are distributed along the western shores of the Cambrian Sea, while those on the east are amply provided for by that portion of the European continent which then stood above water.

If one foot in a century be a quantity so small as to disappoint the imagination of its accustomed exercise, let us turn to the Cambrian succession of Scandinavia, where all the zones recognised in the British series are represented by a column of sediment 290 feet in thickness. If 1,600,000 years be a correct estimate of the duration of Cambrian time, then each foot of the Scandinavian strata must have occupied 5513 years in its formation. Are these figures sufficiently inconceivable?

In the succeeding system, that of the Ordovician, the maximum thickness is 17,000 feet. Its deposits are distributed over a wider area than the Cambrian, but they also occupied longer time in their formation; hence the area from which they were derived need not necessarily have been larger than that of the preceding period.

Great changes in the geography of our area ushered in the Silurian system: its maximum thickness is found over the Lake district, and amounts to 15,000 feet; but in the little island of Gothland, where all the subdivisions of the system, from the Landoverly to the Upper Ludlow, occur in complete sequence, the thickness is only 208 feet. In Gothland, therefore, accord-

ing to our computation, the rate of accumulation was one foot in 7211 years.

With this example we must conclude, merely adding that the same story is told by other systems and other countries, and that, so far as my investigations have extended, I can find no evidence which would suggest an extension of the estimate I have proposed. It is but an estimate, and those who have made acquaintance with "estimates" in the practical affairs of life know how far this kind of computation may guide us to or from the truth.

This Address is already unduly long, and yet not long enough for the magnitude of the subject of which it treats. As we glance backwards over the past we see catastrophism yield to uniformitarianism, and this to evolution, but each as it disappears leaves behind some precious residue of truth. For the future of our science our ambition is that which inspired the closing words of your last President's Address, that it may become more experimental and exact. Our present watchword is Evolution. May our next be Measurement and Experiment, Experiment and Measurement.

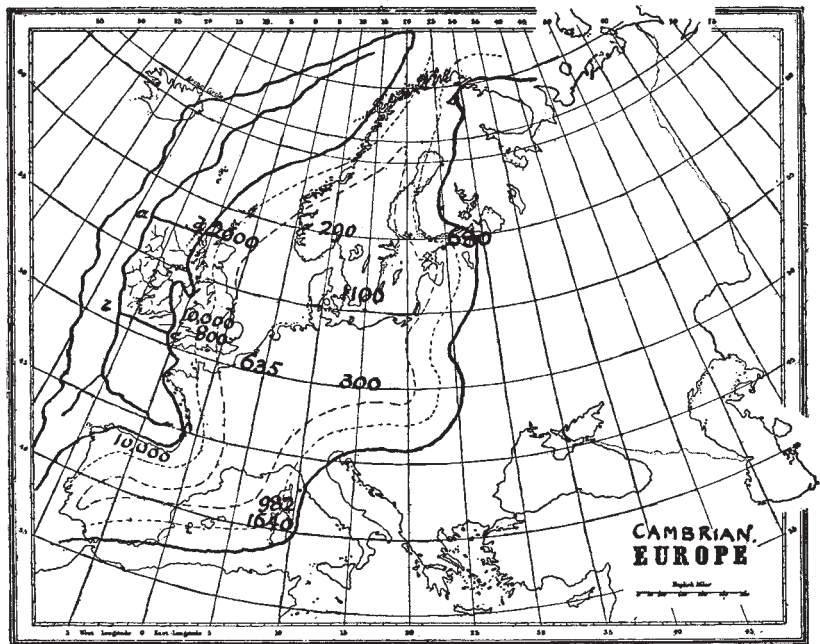


FIG. 2.—Chart of the distribution of land and sea, and of the thickness of deposits of the Cambrian system. The dotted lines indicate distances of 100 and 200 miles from the shore

NOTES.

ANOTHER of those disastrous hurricanes which occasionally visit the West Indies and United States at this season of the year has to be recorded. On the 8th inst. a storm of great violence struck the coasts of Louisiana and Texas, and, owing to the thickly populated districts over which it swept and to the high water wave which accompanied it, immense destruction to property and lamentable loss of life ensued. The fury of the storm is said to have been felt for at least a hundred miles inland, but up to the present time scarcely any details have arrived as to its character and the exact path that it followed. This part of America is one of the three regions referred to in the works of Prof. W. M. Davis from which tropical storms move into temperate latitudes in the northern hemisphere; but we must wait for further details before it can be stated whether the one in question was of the nature of a tornado, which differs from an ordinary hurricane chiefly in its excessive violence over a small, instead of a large, area. From the description so far

given, and from its duration, the storm would appear to have been of the nature of the worst West India hurricanes.

THE *Stella Polare*, with the Duke of the Abruzzi and members of his Arctic expedition on board, arrived at Christiania on Tuesday. A Reuter telegram from Tromsø states that the ship was pushed by the ice in Table Bay right on to the land, and four separate parties were sent out from it. The first was despatched northwards to establish dépôts, and had to travel two days overland. The second party, consisting of a Norwegian and two Italians, was to have been out twelve days, but the men never returned. The third party were away twenty-four days, and the fourth 105 days. This last reached lat.  $86^{\circ} 33' N.$ , thus penetrating a little further north than Dr. Nansen and Lieut. Johansen, who reached lat.  $86^{\circ} 14' N.$  The scientific results of the expedition are said to be satisfactory, but no information concerning them, or of the latitude observations, is yet available.

THE recent Congress of British Chambers of Commerce at Paris adopted resolutions urging the adoption of the metric system of weights and measures in our Government departments, and the teaching of decimals in public elementary schools at an early stage, as an essential part of arithmetic.

THE *Entomologist* for September contains an interesting account of the artificial ant-hills in the Paris Exhibition. These are shown by M. C. Janet, who has devoted many years to studying the habits of the social Hymenoptera. They are made of porous pink plaster covered with glass, through which visitors may observe the movements of their busy inhabitants, and are constructed after the plan of a natural hill in a garden near Beauvois. Several species of ants are exhibited, one of which has "slaves." M. Janet is of opinion that ants have a language of sounds, and that at any rate they produce grating noises, probably by rubbing together their bodies; while he is fully assured that they possess an acute sense of hearing.

TO the current issue of the *Entomologist's Monthly Magazine*, Sir George Hampson communicates a notice of certain malformed specimens of moths recently acquired by the British Museum. The object of the communication is to draw attention, not only to peculiarities of the insects themselves, but likewise to the fact that the authorities of the Museum have recently started a collection to display the abnormalities and "sports" which occur among insects, and, it may be added, among all other groups of animals as well. Sir George Hampson appeals to all entomologists to assist in the formation of this series.

THE chapters on "Nature and Science for Young Folks" in the August and September numbers of *St. Nicholas* maintain, under the able editorship of Mr. E. F. Bigelow, their high standard of excellence and interest, many of the illustrations being unusually attractive and instructive. In the August number we have first a delightful dissertation on "Flowers of the Sea," with an exquisite photograph of a dried sea-weed; this being followed by an account of the manner in which gnat-larvæ maintain their breathing apparatus at the surface of the water during the process of respiration. In the September issue the attention of the young reader is at first attracted to the intrinsic beauty of leaves—such as can be met with in any copse or wood—by an account of how to make leaf-garlands and chains, from which the transition is easy to the numerous points of interest displayed by microscopic sections of these beautiful structures, and to the part they play in the economy of nature. A prize competition in which figures of birds and insects are given for identification by the reader strikes us as an especially good feature, and in every way superior to the useless and hackneyed "missing word competition."

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THE meteorological reporter to the Government of India has issued his usual "Brief memorandum on the weather in India during the months of June and July, and forecast of the general distribution of the rainfall in India during the months of August and September, 1900." The character of the monsoon rains in June and July has been in fair accordance with the forecast issued in the beginning of June. From a consideration of the weather and of the snowfall in the mountains during those months, it is assumed that the general distribution of rainfall for the months of August and September will be favourable. A comparison with several previous years also suggests that it is probable that the rainfall of the retreating south-west monsoon (October to December) will be favourably distributed in the Peninsula.

THE French Meteorological Office has recently issued its *Annales* for the year 1897; the first volume, under the title of "Memoirs," contains, in addition to the usual articles relating to thunderstorms and magnetic observations, a discussion by M. Angot of the temperature at a number of stations since 1851. This valuable paper forms the first part of an investigation of the climate of France during forty years ending with 1890. A second memoir by M. Angot contains the principal results of the simultaneous observations made at the Meteorological Office in Paris and on the Eiffel Tower during six years. M. Teisserenc de Bort, who established and maintains at Trappes an observatory specially devoted to the study of clouds and the movements of the upper air, publishes the results hitherto obtained from numerous ascents of unmanned balloons. The second volume contains the results of observations at stations in France and its Colonies. The publication of the valuable series of rainfall observations, which has hitherto formed the third volume, is postponed for the present, from motives of economy. The Central Office in Paris receives 167 telegraphic reports daily, and in the year in question 89 per cent. of the weather forecasts were successful. The observers receive encouragement in the way of medals, sixty-eight of these were awarded for observations on land, and eighteen for observations at sea. Much attention is now given to the development of observations in the French Colonies, and in distant parts generally, a matter which, until a few years ago, had been somewhat overlooked.

MANY attempts have been made to introduce Euclid's Fifth Book, or its equivalent, in the teaching of geometry, and recently a work on the Fifth and Sixth Books appeared from the pen of Prof. M. J. M. Hill, F.R.S. A later contribution to this subject is a paper, by Prof. George A. Gibson, on "Proportion," a substitute for the Fifth Book of Euclid's Elements, published as an appendix to the *Proceedings* of the Edinburgh Mathematical Society. A deductive treatment of proportion such as this, which takes account of incommensurability, is doubtless a good mental training for the advanced student; but seeing that in an elementary course on arithmetic and algebra the rules for multiplying and dividing negative and fractional quantities are practically never logically proved by students, but rather assumed and applied to working examples, there is surely sufficient precedent for taking it as granted that the laws of proportion apply to incommensurable magnitudes. At any rate the matter is one for discussion between the two schools, one of which seeks to put the teaching of mathematics on a rigorously deductive basis, while the other would abolish Euclid's lengthy deductions and rather teach the results of mathematical reasoning and how to work with them in practical applications.

WE have received a copy of a rectorial address, delivered by Prof. Brückner before the University of Berne, entitled "Die Schweizerische Landschaft einst und jetzt." The topographical changes which have taken place in Switzerland since the glacial

period and within historic times are summarised, and apart from the intrinsic interest of the subject, the address is an admirable illustration of the methods of descriptive geography.

DR. A. LORENZEN contributes two articles to *Die Natur* on the Danish Expedition to East Greenland in 1898-1899. The expedition was successful in closely following the plan of work with which it set out. Its chief results consist of mapping the coast of Greenland from lat. 65° 34' N. to 67° 22' N., and sketching it as far as 68° N.; making botanical, zoological and geological collections; ethnographic observations; observations of the ice north of the Angmagalik district; meteorological and other observations in winter quarters.

OUR German contemporary, *Naturwissenschaftliche Wochenschrift* for August 19 and September 2 contains a full account of the discovery of the remains of *Grypotherium listai* in Ultima Esperanza cavern, Patagonia.

Perhaps the most interesting article in the September number of the *Irish Naturalist* is an account, by Mr. R. Warren, of a visit to Loch Erne in search of the Sandwich tern, which has hitherto been known to breed in Ireland only in a single locality in county Mayo.

THE report of the expeditions organised by the British Astronomical Association to observe the total solar eclipse of May 28, 1900, will be contained in a volume shortly to be issued from the office of *Knowledge*. The work will be edited by Mr. E. Walter Maunder, and will contain many photographs of the various stages of the eclipse.

AMONG the scientific instrument makers who exhibited in the British Section at the Paris Exhibition, the Grand Prix was awarded to four firms, namely:—Class 15 (*Instruments de Précision*), the Cambridge Scientific Instrument Co., Ltd., Cambridge, and Messrs. Ross, Ltd., London. Class 16 (*Médecine et Chirurgie*), Messrs. Down Bros., London. Class 27 (*Applications diverses de l'Électricité*), Mr. James White, Glasgow. Mr. W. Duddell received a gold medal (Class 27) for the oscillograph exhibited by the Cambridge Scientific Instrument Company, and Mr. Wayne, the inventor of both the Wayne and Simplex Steam-engine Indicators, and now engaged at the Cambridge works, received a silver medal. A silver medal was also awarded in Class 16 to the company itself. Two gold and two silver medals were awarded to Mr. J. J. Hicks, and one to Messrs. Crompton and Co., Messrs. Negretti and Zambra, and Messrs. Watson and Sons; and silver medals were also awarded to Mr. A. Higgins, Mr. E. Wellings, Mr. W. Sims and Mr. W. Barton of Mr. Hicks' firm.

THE additions to the Zoological Society's Gardens during the past week include a Lion (*Felis leo*) from Uganda, presented by Captain Delme Radcliff; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Miss K. Bishop; a Ring-tailed Coati (*Nasua rufa*) from South America, presented by Mr. G. Percy Ashmore; two Cuning Bassaris (*Bassaris astuta*) from Mexico, presented by Miss Franklin; two Chilian Sea Eagles (*Geranoaëtus melanolæucus*) from South America, presented by Mr. Tom Simonds; a Puma (*Felis concolor*) from the Argentine Republic, presented by Mr. Maurice F. Dennis; a Nilotic Crocodile (*Crocodilus niloticus*) from Omdurman, presented by Major H. B. Weatherall; two Tenrecs (*Centetes ecaudatus*) from Madagascar, a Cuning Bassaris (*Bassaris astuta*) from Mexico, three Cardinal Eclectus (*Eclectus cardinalis*) from Moluccas, deposited; two Purple Herons (*Ardea purpurea*), two Common Cormorants (*Phalacrocorax carbo*), three Common Spoonbills (*Platalea leucorodia*), European, purchased.

OUR ASTRONOMICAL COLUMN

EPHEMERIS FOR OBSERVATIONS OF EROS.—The following is continued from the new data given by E. Millosevich in the *Astronomische Nachrichten* (Band 153, No. 3660):—

Ephemeris for 12h. Berlin Mean Time.

1900.	R.A.			Decl.
	h.	m.	s.	
Sept. 13	2	34	19.43	+38° 7' 24.2"
14	35	11.87	...	38 30 7.3
15	36	2.36	...	38 52 52.9
16	36	50.83	...	39 15 40.7
17	37	37.20	...	39 38 30.3
18	38	21.38	...	40 1 21.4
19	39	3.30	...	40 24 13.9
20	2	39	42.89	+40 47 7.2

The following elements for two epochs some two years apart are also given in the same periodical:—

I. Epoch 1898 August 2.5 Berlin.		II. Epoch 1900 October 31.5 Berlin.	
M = 205	21 41.83	M = 304	24 40.34
π = 121	10 51.40	π = 121	9 47.82
Ω = 303	31 56.17	Ω = 303	30 50.02
i = 10	49 35.35	i = 10	49 38.97
φ = 12	52 14.44	φ = 12	52 40.61
μ = 2015	.26908	μ = 2015	.23324
log a = 0.1637824		log a = 0.1637875	

THE DAYLIGHT METEOR OF SUNDAY, SEPTEMBER 2.

JUST before sunset on September 2 a magnificent meteor was observed in the north of England and Scotland. A large number of descriptions of the object have appeared in the newspapers, and it appears that notwithstanding broad daylight the spectacle was a very brilliant one.

At St. Anne's, Lancashire, the meteor fell in a northerly direction, and left a column of white smoke, which remained visible ten minutes. At Hunt's Cross the time was noted as 6h. 52m., and the object is said to have fallen near Halewood, leaving a long trail of white dust for several minutes. As seen from Birkenhead the meteor appeared at 6h. 54m. in the N.E., and looked like a descending rocket. Its path was nearly vertical, and it left a "dust trail" for nearly six minutes. At Wetherby, Yorks, the smoke-like cloud left by the nucleus remained visible until 7h. 30m. At Overton, Ellesmere, the object is said to have apparently fallen on a field on the left bank of the Dee, about a mile from Bangor Iscoed. At Ulverstone it passed over Morecambe Bay, in a southerly direction towards Blackpool. At Penton, Cumberland, the time was noted as 6h. 54m., and the direction was due south. It remained visible two seconds, and was falling towards the earth.

At Keswick, Mr. Lawson Dykes saw the fireball at 6h. 55m., and says it fell through an arc of about ten degrees, the altitude of appearance being 35° and disappearance 25°. It was pear-shaped and of immense size, with a distinct tail. The line of flight was almost due N. to S. At Warkton, Northamptonshire, Dr. Herbert Spencer noted the time as 6h. 55m., and says the track of the meteorite was afterwards marked by a narrow white streak, which persisted for more than five minutes.

At and near Edinburgh the fireball was witnessed by many persons. One observer says that at 6h. 55m. there was a sudden flash, and what appeared to be a streak of molten silver followed by a train of sparks whizzed past, apparently falling into a large field of turnips on his right hand. Its direction was due S.E. At Inveresk the meteor appeared to be in the direction of Dalkeith. It resembled a large ball of fire with a tail, and seemed to fall to the earth. At Earlswood, nine miles S.S.E. of Birmingham, the time was noted as 6h. 55m., and the end point of the flight occurred in altitude 20° N. and was directed from N.N.E. At Blackwall, Alfreton, an observer noted the time as 6h. 53m., and says the meteor left a trace in the sky of a sinuous form and in colour a silver-gray. The trace remained distinctly visible in the sky for thirty minutes. Its direction was N.W. At West Kirby, Birkenhead, the meteor was seen to fall into a wood on the east side of the hill there, and apparently so close that the observer thought it would possibly set fire to the trees.